NON-PUBLIC?: N
ACCESSION #: 8904170217

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Duane Arnold Energy Center (DAEC) PAGE: 1 of 4

DOCKET NUMBER: 05000331

TITLE: Main Steam Isolation and Reactor Scram Due to Solenoid Failure on MSIV
EVENT DATE: 03/05/89 LER #: 89-008-00 REPORT DATE: 04/04/89

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Kenneth S. Putnam, Technical Support Engineer

TELEPHONE: 319-851-7602

COMPONENT FAILURE DESCRIPTION:
CAUSE: D SYSTEM: JM COMPONENT: CL MANUFACTURER: A609
REPORTABLE TO NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On March 5, 1989 with the reactor operating at 100% power, calibration of the Main Steam Line Radiation Monitors was in progress when the 'B' Outboard Main Steam Line Isolation Valve (MSIV) unexpectedly closed due to a failed DC solenoid. The isolation of the B' Main Steam Line (MSL) resulted in flow in the remaining three main steam lines exceeding the high flow limit of 140%. In accordance with design this resulted in isolation of all Main Steam Lines. When MSIV's reached the less than 90% open position, an automatic reactor scram occurred. Reactor pressure peaked at approximately 1126 PSIG and was controlled with the use of four pressure relief valves. All safety systems performed as expected and operator response was appropriate.

The cause of the failed solenoid coil was moisture intrusion. The source for the moisture was condensation from a nearby minor steam leak. The solenoid enclosure was susceptible to moisture intrusion as a result of inadequate

torquing of a threaded cover for the enclosure during previous maintenance activities in December 1988. The lack of proper torquing was due to an inadequate maintenance repair procedure. The failed solenoid was replaced. Other MSIV fast closure solenoids were inspected for moisture intrusion and the enclosures were properly torqued. The repair procedure has been revised.

END OF ABSTRACT

I. DESCRIPTION OF EVENT:

On March 5, 1989 at 0722 hours the reactor was in normal power operation at approximately 100% power. The Main Steam Line Radiation Monitors (EIIS System Code JM) were being sequentially calibrated. The calibration was being performed in accordance with a surveillance test procedure. As part of the surveillance a half Group I isolation signal and a half scram signal is generated. The half scram and the half Group I were reset on channel A2 of the logic and the calibration of channel B1 was commenced. The 'B' outboard isolation valve (EIIS System Code SB) unexpectedly closed. In response to the isolation of the 'B' main stea
line, the three remaining steam lines
experienced a rapid increase in flow and reactor pressure increased from approximately 1004 psig to approximately 1039 PSIG. With the increase in reactor pressure, neutron flux increased from approximately 100% to roughly 115% of scale. The combined effect of an increased reactor power, the loss of flow in the 'B' main steam line, and turbine control valve response to the increased reactor pressure resulted in flow through the remaining three steam lines exceeding the main steam line high flow setpoint of 140% of normal full flow. Per design, this condition resulted in the initiation of a full Group I isolation. The Reactor Protection System properly responded to this condition and initiated a Reactor Scram when the MSIV's reached less than the 90% of full open position.

In response to the Group I isolation, reactor pressure increased to approximately 1126 PSIG. This pressurization transient in combination with the reactor scram resulted in reactor level decreasing for an extremely short period of time to at or near 119 inches above the top of active fuel. Automatic isolation of Primary Containment Group II-V (EIIS System Code JM) valves occurred as expected. High Pressure Coolant Injection (HPCI) (EIIS System Code BJ) and Reactor Core Isolation Cooling (RCIC) (EIIS System Code BN) systems initiated but did not inject as level was restored using normal feedwater prior to HPCI/RCIC systems reaching injection conditions. Reactor pressure was controlled with relief valves PSV-4400, PSV-4401, PSV-4402, and PSV-4407 opening (EIIS System Code SB). PSV-4401 and PSV-4407 subsequently controlled pressure between 900 and 1025 PSIG in the LO-LO Set mode, per

design.

Following this initial transient, the feedwater system raised reactor level beyond normal level to the high level trip point of 211 inches for HPCI, RCIC, Main Turbine, and the Feedwater pumps. Operators then manually reduced reactor pressure to approximately 730 PSIG and stabilized level and pressure within the accepted range using HPCI and RCIC systems in manual mode with a combination of injection to the vessel and Condensate Storage Tank (CST) recirculation. At this

point the plant conditions were fully stabilized and operators proceeded to cold shutdown in accordance with normal operating procedures, to permit troubleshooting of the problems with the 'B' MSIV and for planned maintenance on balance of plant equipment in preparation for summer operating conditions.

II. CAUSE OF EVENT:

The cause of the unexpected closure of the 'B' Main Steam Line Isolation Valve was a failure of SV-4416B, a DC solenoid coil. Solenoid SV-4416B works in combination with an AC coil, SV-4416A, to control a three-way valve that normally supplies nitrogen to the MSIV actuator to hold it open. Both solenoids must be de-energized for the MSIV to close. In this event the DC coil was open and when testing de-energized the AC coil, the MSIV closed. Failure of the DC coil was not readily detectable as no direct indication of solenoid status exists. Inspection of the failed coil found it saturated with water. The source of the moisture was traced to a steam leak from a nearby valve which condensed and dripped onto the solenoid housing. The type of housing installed is designed to withstand service conditions of this type. The failed solenoid housing was due to inadequate torquing of the threaded cover on the housing. The solenoid valve had received routine preventive maintenance on December 16, 1988. A review of repair procedures used for the maintenance found that the procedures lacked a specific torque value for the threaded housing cover. The individuals performing the work did not perceive cover torquing as a critical item in the work. The procedure was for ASCO Model 8323 solenoid valves but failed to recognize that ASCO Model 8323 solenoid valves can come with a variety of enclosure types. The procedure addressed an enclosure type which utilized capscrews and not a threaded cover as installed on SV-4416B. Testing of the solenoid housing following the failure found the housing to be extremely susceptible to moisture intrusion when the cover was not properly torqued. Testing of housing performance when properly assembled and torqued found the housing withstood conditions simulating the high moisture environment it was exposed to in service with no moisture intrusion into the housing interior.

III. ANALYSIS OF EVENT:

Plant response to the event was normal with all safety systems performing as expected. The closure of one or all MSIVs is a fully analyzed event. There was no affect on plant safety. Operator actions were appropriate and restored the plant to a stable condition at approximately 0735 hours.

The intrusion of water into the solenoid did not constitute degradation of the Environmental Qualification of this component as the safety function of this solenoid is to de-energize. Moisture intrusion does not disable this function. Had the improperly torqued enclosure cover existed under accident conditions, the safety function of primary containment isolation would not have been prevented.

IV. CORRECTIVE ACTIONS:

The other MSIV fast closure solenoid valve coil enclosures were inspected and found free of moisture intrusion. The housing covers were then properly torqued to the specified value. The maintenance repair procedure has been revised to provide specific direction on repair of solenoid valves of this type. An engineering modification will be made to provide direct indication of solenoid status by June, 30, 1990.

V. ADDITIONAL INFORMATION:

The failed solenoid was an Automatic Switch Company model NP8323A36V with a model number 80033 watertight explosion proof enclosure.

No previous failures of this type for the Main Steam Isolation Valves have been identified at the Duane Arnold Energy Center.

Iowa Electric Light and Power Company

March 30, 1989
DAEC-89-0174

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License DPR-49
Licensee Event Report #89-008

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject Licensee Event Report.

Very truly yours,
Rick L. Hannen
Plant Superintendent - Nuclear

RLH/KSP/go

cc: Director of Nuclear Reactor Regulation
Document Control Desk
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D. C. 20555

NRC Resident Inspector - DAEC

File A-118a

Duane Arnold Energy Center 3277 DAEC Road Palo, Iowa 52324 319/851-7611

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